(12) UK Patent Application (19) GB (11) 2 332 722 (13) A

(43) Date of A Publication 30.06.1999

(21) Application No 9727372.6

(22) Date of Filing 29.12.1997

(51) INT CL[6]
F16B 19/10

(52) UK CL (Edition Q)
F2H HARN H11B12 H11B22B

(56) Documents Cited
GB 2288649 A US 5044850 A

(58) Field of Search
UK CL (Edition P) F2H
INT CL[6] F16B 19/10

(71) Applicant(s)
Emhart Inc
(Incorporated in USA - Delaware)
Drummond Plaza Office Park,
1423 Kirkwood Highway, Newark, Delaware 19711,
United States of America

(72) Inventor(s)
Daniel Robin Smith
Stephen John Morris

(74) Agent and/or Address for Service
Black & Decker Europe
The Patent Department, 210 Bath Road, SLOUGH,
Berkshire, SL1 3YD, United Kingdom

(54) Abstract Title
Blind rivet with work hardened groove in shank

(57) A blind rivet assembly 10 for anchoring in soft materials comprises a tubular body 2 having a shank 6 and a preformed head 8. A mandrel 4 having a head 26 extends through the tubular body 2, and has a breakneck 36. A plurality of axial slots 12 are provided in an expandable portion 16 at the end of the shank 6 remote from the head 8. The expandable portion 16 terminates, remote from the end, in a work hardened portion 38 formed by forming a groove 22 in the outside of the tubular body 2.

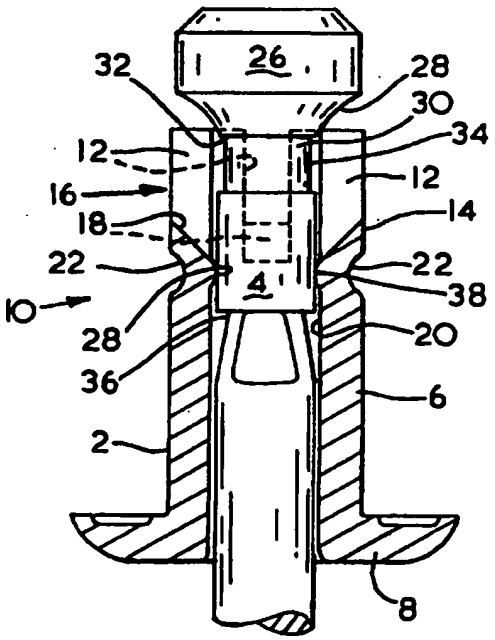

FIG. 1

GB 2 332 722 A

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

1/1

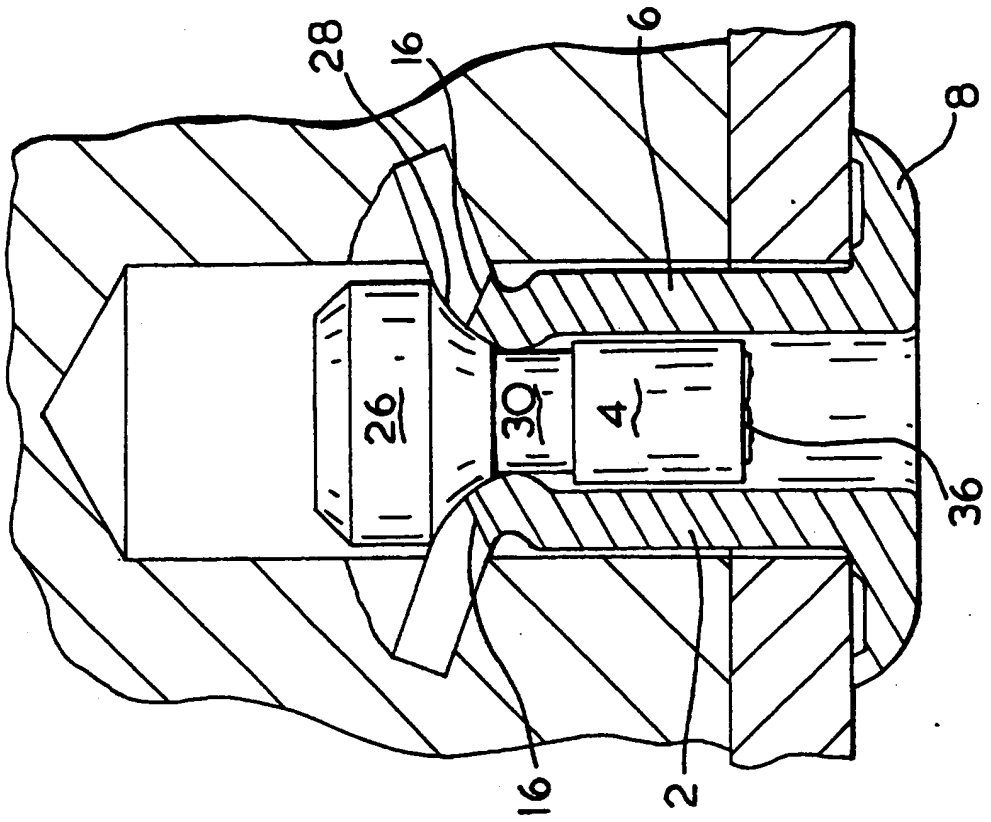
28
16
6
8
26
30
4
36
16
2

FIG. 2

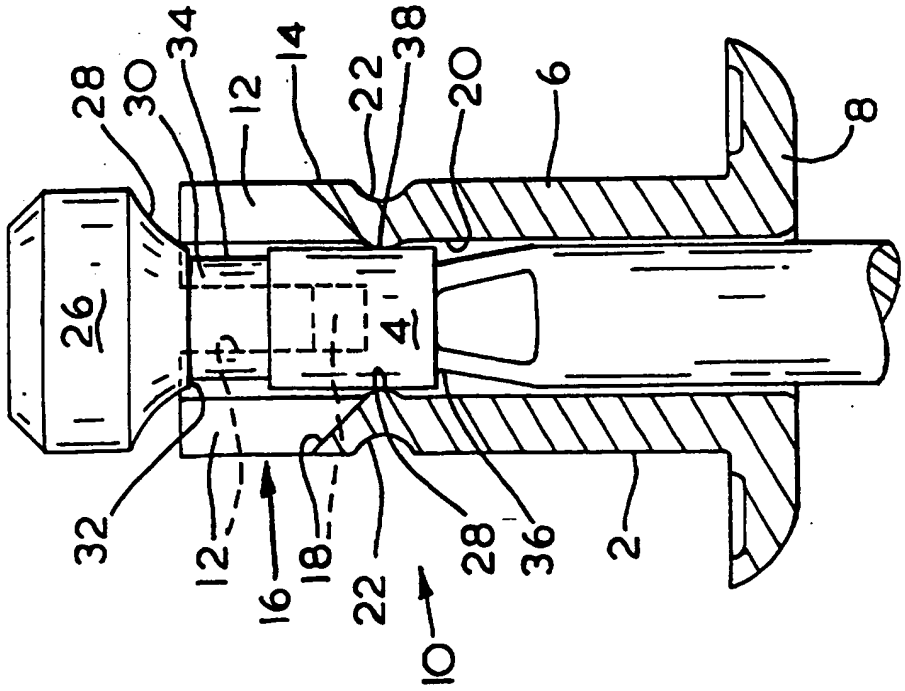
28
30
34
12
14
22
38
20
6
8
26
4
32
12
16
18
22
10
28
36
2

FIG. 1

2332722

IMPROVED BLIND RIVET

The present invention relates to an improved blind rivet, which is particularly suitable for anchoring in relatively soft materials.

Conventional blind riveting techniques are normally used to secure together two or more sheets of workpiece, by forming a blind side bulge on the blind side of the rivet, which bulge co-operates with the flange of the rivet on setting.

Where the blind side workpiece material is both of substantial thickness and is relatively soft, and is required to be secured to a thinner piece of material on the non-blind (operator) side, it is common practice to provide a hole which is of a finite depth, and to secure by means of a thread forming screw. Using this technique, it can be difficult to obtain a reliable and satisfactory fixing since the torque setting required to secure and tighten the screw is critical. If too high a torque is used, the thread will strip and if too low a torque is used, then the thread may not be fully applied. The difference between too high and too low a torque can be small.

Further, if such fixings are subject to loading and in particular to impact loading e.g. drop tests, then due to the relatively low strength of the workpiece material either the screw may pull out or the joint may be loosened.

Despite the potential for improved productivity, conventional blind rivets are not considered suitable for these applications since the workpiece material is usually too soft to prevent complete pull-through of the mandrel head from the rivet body. Also there is insufficient expansion of the rivet body after setting to prevent the

rivet being pulled out in use when the joint is subjected to loading.

A blind rivet for anchoring in relatively soft materials is described and claimed in European Patent Application No. 328, 314. The rivet described in this application has relatively low resistance to pull-out, which makes it unsuitable for some applications.

It is an object of the present invention to provide a blind rivet assembly for anchoring in relatively soft materials, in which the above disadvantages are reduced or substantially obviated.

The present invention provides a blind rivet assembly for anchoring in relatively soft materials, which rivet assembly comprises:

a tubular body having a shank and

a preformed head at one end of the shank;

and a mandrel extending through the tubular body, the mandrel having a head having a maximum external diameter greater than the internal diameter of the body and having an underhead shape progressively increasing in diameter towards the maximum diameter of the head, and a breakneck;

characterised in that the body has an expandable portion at the end of the shank remote from the head in which a plurality of slots are provided, and the expandable portion terminates remote from the end, in a work hardened portion.

The work hardened portion in which the expandable portion terminates is preferably formed by forming a groove in the outside wall of the tubular body. The material displaced as a result of the formation of this groove is preferably allowed to form a projection into the tubular

bore, which projection serves as a mandrel retaining feature.

The mandrel preferably includes a portion of reduced diameter immediately adjacent to the underhead shape.

The base of each of the slots provided in the end of the shank is preferably inclined so that the slot is deeper adjacent to the bore than it is adjacent to the outer wall of the rivet body.

A preferred embodiment of a blind rivet assembly will now be described, with reference to the accompanying drawings, in which:

Figure 1 is a view, partially in section, of an assembled rivet prior to setting, and

Figure 2 is a view, partially in section of the rivet of Figure 1 after setting.

As can be seen from Figure 1, a blind rivet assembly 10 comprises a tubular body 2 and a mandrel 4. The body 2 comprises a shank 6 and a head 8. Four equally spaced slots 12 are provided in the end 14 of the shank 6 remote from the head 8, and provide an expandable portion 16 of the shank. The bases 18 of the slots 12 are inclined in the direction shown so that the slot 12 is deeper adjacent the bore 20 of the rivet body 2.

A groove 22 is provided in the outside wall of the tubular body 2, beneath the slots 12 and a projection 24, formed by the material displaced by formation of the groove 22, projects into the bore 20.

The formation of the groove (22) leads to work hardening of the rivet body (2) adjacent to the groove (22), so providing a work hardened portion (38).

The mandrel 4 comprises a head 26, the underhead shape 28 of which increases progressively in diameter towards the maximum diameter of the head. Immediately adjacent to the underhead shape 28, the mandrel 4 has a portion 30 of reduced diameter, defining a shoulder 32 and recess 34.

The mandrel 4 is further provided with a breakneck 36. Figure 1 shows the rivet assembly prior to setting.

As can be seen from Figure 2, the rivet is set in the same way as a conventional blind rivet, by pulling the mandrel 4.

As the rivet is set, the curved portion 28 beneath the mandrel head 26 engages the tail end 14 of the rivet body 2 so that the separate portions bend outwardly and in doing so the legs cut into the workpiece. Bending of the legs is initiated at the groove 22 in the rivet body 2 and as the head 26 of the mandrel 4 progresses towards the flange 8 of the rivet body 2 the setting load increases due to the increased resistance resulting in a bending movement on the legs. As the head 26 of the mandrel 4 approaches the groove portion 22, the groove 22 tends to collapse and in doing so causes material in the base of the rivet body adjacent to the groove 22 to be displaced inwardly into the recess 34 beneath the mandrel head 26 thus locking the mandrel 4 into the body. The setting load increases sharply to break the mandrel 4 at the breakneck 36.

Also, as the legs of the rivet body 2 bend the inner surface of the legs near the groove 22 tends to increase in length. Material from the rivet body to accommodate this stretching will be provided from the section of the leg at that point, in a movement known as an anticlastic movement. In order for this material to move without undue stress the base 18 of the slots 12 is inclined.

CLAIMS

1 A blind rivet assembly (10) for anchoring in relatively soft materials, which rivet assembly comprises:

a tubular body (2) having a shank (6) and

a preformed head (8) at one end of the shank (6);

and a mandrel (4) extending through the tubular body (2), the mandrel (4) having a head (26) having a maximum external diameter greater than the internal diameter of the body (2) and having an underhead shape (28) progressively increasing in diameter towards the maximum diameter of the head (26), and a breakneck (30);

characterised in that the body (2) has an expandable portion (16) at the end (14) of the shank (6) remote from the head (8) in which a plurality of slots (12) are provided, and the expandable portion (16) terminates, remote from the end (14), in a work hardened portion (38).

2 A blind rivet assembly according to claim 1, characterised in that the work hardened portion (38) is formed by forming a groove (22) in the outside wall of the tubular body (2).

3 A blind rivet assembly according to claim 2 characterised in that the material displaced as a result of the forming of the groove (22) is allowed to form a projection (24) which projects into the tubular bore (20) of the body.

4 A blind rivet assembly as claimed in any of claims 1 to 3 characterised in that the mandrel (4) has a portion (30) of reduced diameter immediately adjacent to the underhead shape (28).

5 A blind rivet assembly as claimed in any of claims 1 to 4, characterised in that the base of each of the slots (12) is inclined so that the slot (12) is deeper adjacent to the bore (20).

6 A blind rivet assembly substantially as herein described and with reference to the accompanying drawings.

The Patent Office

Application No:	GB 9727372.6	**Examiner:**	Robert H Games
Claims searched:	1-6	**Date of search:**	6 May 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F2H

Int Cl (Ed.6): F16B 19/10

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
A	GB 2288649 A	(AVDEL SYSTEMS) see zones 25,29 of increased hardness and page 11 lines 18-21	
A	US 5044850	(AVDEL CORPORATION) see whole document especially column 3 lines 16-24	

7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.